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ESTIMATION OF SYNCHRONOUS GENERATOR PARAMETERS IN A LARGE SCALE POWER SYSTEM

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Abstract. *A method for estimation of parameters of synchronous generators in a large scale power system is suggested in this paper. The method is based on the identification of the parameters of the state space model. The identification algorithm has two parts. First, the continuous state space model is transferred to the discrete state space form. Next, some theoretical relations are derived from the discrete-time equations. The derived equations lead to a solution for the generator parameters. The method requires measurement of the active and reactive output power, the generator rotor angle, the field voltage and current, and also the armature current following a small perturbation of the field voltage. The derived algorithm is applied to a sample power system model. Simulation results admit the accuracy of the estimated parameter.*
Keywords: Discrete model, Estimation, Multi-machine power system, Large scale system, Synchronous generator

1. **Introduction.** Parameter identification from operating data for synchronous generators is a beneficial procedure which does not require any service interruption to perform. Thus, machine parameters, which can deviate substantially from manufacturer values during online operation at different loading levels, can be determined without costly testing [1]. These deviations are usually due to magnetic saturation, internal temperature, machine aging, the effect of centrifugal forces on winding contacts and incipient faults within the machine [2].

Estimation of parameters of a synchronous generator connected to an infinite bus has been well established in the literature [2-5]. In practical multi-machine power systems, synchronous generators have interactions on each other and it is not correct to neglect the interaction effects. In this study, the objective is to extend the suggested method in [4] to large-scale power system model and find the synchronous generator parameters when the machine is in service and works as a part of a large-scale power system. In other words, we do not need to find an isolated model for the generators and we do not neglect the interaction effects. The parameters can be estimated in the real large-scale model. The estimated parameters are useful for modeling purposes, stability analysis and controller design [6].

Depending on the aim of modeling, different structures can be used for the system. In this study, a third order nonlinear structure has been adopted. Compared with the seventh order nonlinear structure (the highest accuracy, commonly used), it neglects the effects of damper windings and the dynamics of the stator. These two effects can be neglected, especially when the very fast dynamics (sub-transients) are not of interest [3].